Call for FY 2007 DoD Challenge Project Proposals

Introduction

This call for proposals is for large, computationally intensive projects that require the use of DoD High Performance Computing Modernization Program (HPCMP) shared resource center systems. Successful proposals shall receive allocations of high-priority computational time on HPCMP shared resource systems. The High Performance Computing Modernization Program Office (HPCMPO) has designated approximately 30% of total HPCMP computational resources to be allocated for these large projects, referred specifically to as, DoD Challenge Projects.

Definition: DoD Challenge Projects may require resources across multiple hardware platforms and may span multiple shared resource centers. An approximate minimum central processing unit (CPU) requirement for projects is 200 gigaflops-years annually, equivalent to approximately 250,000 processor-hours on an IBM P4+ or 300,000 processor-hours on an SGI Altix or a Linux Networx Xeon cluster. This approximate threshold should be considered as a guideline for proposal purposes. Services and Agencies may submit DoD Challenge Project proposals for high-priority projects with annual requirements considerably less than this threshold to ensure greater participation in the Challenge Project proposal process. All DoD Challenge Project proposals must meet the same standards for scientific and computational merit.

Eligibility: All computational scientists and engineers in DoD science and technology and test and evaluation programs who are eligible to use HPCMP resources under its current guidelines may submit DoD Challenge Project proposals.

Submission: Proposals must be submitted through the Service/Agency High Performance Computing Advisory Panel (HPCAP) principals to the HPCMPO. Although DoD Challenge Project proposals are due to the HPCMPO from the Service/Agency principals by 24 March 2006, each Service and Agency may establish earlier internal deadlines for submission so that proposals may be screened and prioritized prior to sending them to the HPCMPO. The HPCMPO requires proposals in Microsoft Word 95 or later format by e-mail. The Service/Agency points-of-contact for information concerning submission of Challenge Project proposals are as follows:

Air Force: Dr. Leslie Perkins, Leslie.Perkins@wpafb.af.mil

Army: Mr. Harold Breaux, harold@arl.army.mil, or Mr. Robert Sheroke, rsheroke@arl.army.mil

Navy: Dr. Ronald Joslin, JoslinR@onr.navy.mil

DTRA: Ms. Jackie Bell, Jacqueline.Bell@dtra.mil

MDA: Mr. Guy Hammer, Guy.Hammer@mda.osd.mil

C3I (NIMA): HPCMPO, require@hpcmpo.hpc.mil

DARPA: Dr. Steven Walker, swalker@darpa.mil

Questions: Please contact the HPCMPO via e-mail (require@hpcmo.hpc.mil) or call 703-812-8205 and ask for Dr. Larry Davis or Ms. Cathy McDonald.

Evaluation: The DoD Challenge Board will technically evaluate and recommend proposals for implementation to the HPCMPO. The Challenge Board consists of representatives from each of the Services and DoD Agencies as appropriate. The board also includes technical experts outside of the DoD.

Awards: Award announcements are planned for July 2006.

Consideration: Proposals submitted for the FY 2007 evaluation may be either one-year proposals or multi-year proposals (two or three years). FY 2007 DoD Challenge Project allocations will be provided for the entire fiscal year beginning 1 October 2006. FY 2008 allocations for successful multi-year proposals extending into FY 2008 will be made after a review of FY 2007 progress as part of the FY 2008 DoD Challenge Project proposal evaluation process.

Proposal Contents

Proposals are limited to 15 pages (single-spaced, standard 12-point font, one-inch margins). It should be noted that the cover page, resource request, and curriculum vitae do not count toward the 15-page proposal limit. Proposals will be structured such that they contain the following sections in the order given. Each proposal should address each and every point in all eight sections. **Proposals that do not conform to this structure may be returned without further evaluation.**

Cover Page: This section should provide a brief description of the following (in one page). Please refer to the sample cover page provided as an attachment:

- *Title*: Title of the project.
- *CTA*: List the computational technology area (CTA) to which the project belongs.
- *Project Leader*: List the name of the project leader.
- *Government Point of Contact*: List the name of the Government Point of Contact for the project.
- *Sponsoring Service/Agency and Organization*: List the Service/Agency and organization sponsoring the Challenge Project.
- *Technical Goals*: Provide broad technical goals of the Challenge Project.
- *Specific objectives*: Specify specific objectives of the project.
- *Technical Approach*: Describe the technical approach.
- *Major Applications Software*: List major applications software proposed for use.

- *Technical and Computational Challenges*: Describe technical and computational challenges to be encountered in the course of the project justifying DoD HPC resources.
- *DoD Impact*: Specify DoD impact of the Challenge Project computations.
- *Schedule*: Specify the years for which HPC computational resources are requested.
- *Keywords*: Summarize keywords used in the proposal.

The contents of this cover page will be used in high-level DoD presentations.

1. *Introduction:* This section should be used to introduce the project and put into perspective in broad, general terms. Include a general discussion of ongoing related work in both your organization and the entire scientific, technology, and testing community.

2. *Justification/DoD Relevance:* This section will be used primarily to assess the mission relevance of the proposed project and determine its Service/Agency mission priority. Clearly state the military relevance of the project and what current and future DoD weapons systems it will support, if any. Show how the computational work in this proposed project supports the science and technology or developmental test and evaluation program of DoD and/or your laboratory or test center, respectively. State the military advantage to be gained by exploiting HPC capability in this project.

3. *Technical Approach:* **This section is the heart of the proposal.** Ensure that both computational science and computer science issues are discussed. Clearly state the technical goals of the project and lay out a program plan for achieving those goals. Estimate the size of the group to be working on the project and name the key players. State clearly whether the project proposed is a one-, two-, or three-year effort and for each year provide a schedule with estimated milestones and anticipated accomplishments. Describe the computational methodology and algorithms, estimating the size of the problem as specifically as possible. Discuss specifically the operational/production level status of software to be used by the project, particularly the software's efficiency on scalable systems by stating its performance as a function of degree of parallelism. It is particularly important that application codes to be used on this project be fully developed and ready to use from the project's start. Show evidence that the software is well optimized and operates efficiently and responsibly in an environment where resources are shared. Discuss technical and computational challenges to be encountered in the course of the project.

4. *Progress to Date***:** If this is an existing computational project, discuss your progress to date in this section of the proposal. Elaborate on any HPC resources located at any of the shared resource centers that were utilized by this project or efforts leading up to this project. Discuss what remains to be done on this project and why it must now be done as a DoD Challenge Project.

5. *Required Resources and Justification:* Fully justify computational resources required to accomplish this project in terms of total processor hours on specific HPCMP systems for FY 2007. **A list of these available systems is attached**. As we complete our FY 2006 acquisitions, the set of available systems may change, and the list of HPC systems in the attachments will be updated on the HPCMP Web site (http://www.hpcmo.hpc.mil) as those

changes are made. The best justification for the required level of computational resources can be provided by documenting known run times on the same architecture as proposed for the project. Provide good estimates of the number of known runs of the type required for the project. Also provide justification for the number of runs requested. If the effort requires larger runs than have previously been made, provide a reasonable estimate of run times for these larger runs based on known scaling laws for the particular algorithms being used, if available. Include and justify memory, storage, networking, and software requirements. **To be eligible for consideration as a DoD Challenge Project, the proposal must contain a well thought out estimate of the computational resources required.**

For a multi-year project, provide estimates of second- and third-year requirements based on first-year estimates. Please include one, and only one, *DoD Challenge Project Resource Request* form for each year of support requested. Consideration for continuation of the project for its second and third year will include a re-evaluation of out-year estimates from this original proposal and actual utilization.

Proposals may present two or more options for utilizing HPC systems at the shared resource centers. *The requirements stated in this DoD Challenge Project proposal **must** be included in the HPCMP's requirements database as updated in the most recent requirements gathering process.* Explain any major differences between the resources requested for this DoD Challenge Project and those previously stated on the project's requirements analysis questionnaire.

6. *Computational Summary Sheet:* A completed *DoD Challenge Project Resource Request* must accompany each proposal. A consolidated request for resources for the DoD Challenge Project is required; do not provide multiple requests for individual sub-projects. Section II of this summary sheet, which contains computational, memory, and secondary storage (all temporary disk space required while a job is running) requirements, must be completed for each option and each year described in the resources section of the proposal. Thus, each summary sheet must contain at least one set of two tables for each year of the proposed work. The computational project titles and project numbers must be included and may be obtained from your organization's Service/Agency Approval Authority (S/AAA). For Challenge Project proposals that span multiple computational projects, provide an estimate of the percentage of resources that will be used by each of the component computational projects. These resource request sheets do not count toward the 15-page proposal limit.

7. *Curricula Vitae:* Include a *curriculum vita* for each of the key personnel, with a relevant publication list. *Curricula Vitae* do not count toward the 15-page proposal limit.

Proposal Evaluation

Criteria: Proposals will be judged on the following criteria:

1. DoD mission priority,

2. Military advantage gained by exploiting HPC,
3. Scientific merit of the proposed project,
4. Computational merit of the proposed project,
5. Potential for significant progress, and
6. Appropriateness of requested resources for the proposed project.

Process: Proposals will be evaluated technically by the DoD Challenge Board. The board consists of representatives from each of the Services and DoD Agencies as appropriate. The board also includes representation from outside of DoD. Each proposal will be evaluated and prioritized in terms of its mission relevance ("DoD mission priority" and "military advantage gained by exploiting HPC" criteria) individually by its Service or DoD Agency, in addition to an OSD review panel to determine an overall OSD priority rating. The HPCMP Director will consider the technical evaluation, the Service/Agency mission relevance evaluation, and the OSD prioritization in constructing a set of recommended DoD Challenge Projects for the Deputy Undersecretary (Science and Technology) to consider in making the final selection.

Schedule

Date	Action
25 January 2006	HPCMPO issues call for FY 2007 DoD Challenge Project proposals and requests for FY 2007 allocations for continuing DoD Challenge Projects
24 March 2006	New FY 2007 DoD Challenge Project proposals due to HPCMPO Requests for FY 2007 allocations for continuing DoD Challenge Projects due to HPCMPO Services and Agencies have earlier internal deadlines
27 March – 19 July 2006	Review and selection process • Initial analysis by HPCMPO • Evaluation of new proposals by Challenge Board • Determination of OSD priorities of new proposals by DUSD (S&T) staff • Review of progress of ongoing Challenge Projects by Challenge Board • Development of recommendations by HPCMPO • Selection by Director, HPCMP and DUSD (S&T)
21 July 2006	FY 2007 DoD Challenge Projects announced by Director, HPCMP
1 October 2006	Implementation of FY 2007 DoD Challenge Projects at HPC centers

DoD High Performance Computing Modernization Program
Computational Resources
Available for FY 2007 DoD Challenge Projects

Location	DoD HPCMP System	Number of Processors
Army Corps of Engineers Engineer Research and Development Center (ERDC)	SGI O3K	1,008
	Cray XT3	4,128
Naval Oceanographic Office (NAVO)	IBM p655+ P4	2,832
	IBM p655+ P4	464
	IBM p655 P5	2,912
	IBM p655 P5 (Classified)	1,824
Army Research Laboratory (ARL)	Linux Networx Xeon Cluster	2,048
	Linux Networx Xeon Cluster	4,464
	Linux Networx Xeon Cluster (Classified)	3,348
	IBM Opteron Linux Cluster (Classified)	2,304
Aeronautical Systems Center (ASC)	SGI Altix	2,000
	HP Opteron Cluster	2,048
	SGI O3K	2,032
Army High Performance Computing Research Center (AHPCRC)	Cray X1E	1,008
Arctic Region Supercomputing Center (ARSC)	Cray X1	496
	IBM Regatta P4	800
Maui High Performance Computing Center (MHPCC)	IBM SP P4 (Classified)	320
Space and Missile Defense Command (SMDC)	SGI O3K	512
	SGI O3K (Classified)	64
	Atipa Linux Cluster	256

DoD Challenge Project Resource Request

Project Title:

Section I:

Project Leader Identification

Name: _____

Service/Agency: _____

Organization: _____

Address, City, State, and Zip Code:

_____

E-Mail Address: _____

Phone: (_____)_____ DSN: _____ Fax: (_____)_____

Section II: Overall Project Resource Requirements

Platform(s)	Location		CPU Resources (processor-hours)	
	First Choice	Second Choice	Request	Minimum Acceptable

Platform(s)	Typical Number of Processors	Maximum Number of Processors	Typical Job Memory (GB)	Maximum Job Memory (GB)	Typical Job Secondary Storage (GB)	Maximum Job Secondary Storage (GB)

Section III: Related Requirements Computational Project(s)

Related Requirements Project Title(s): _____

Related Requirements Project Number(s) and Percentages of Work to be Performed by Each:

_____

Sample Proposal Cover Page

Title: Time Accurate Computational Simulations of Ship Airwake for DI, Simulation and Design Applications

CTA: CFD

Project Leader: Susan Polsky

Government Point of Contact: Susan Polsky, (123) 456-7890, email address

Sponsoring Service/ Agency and Organization: US Navy, Naval Air Warfare Center, Aircraft Division (NAWCAD), Patuxent River, MD 20670

Technical Goals: Prediction and characterization of the unsteady nature of the airwake produced by US Navy Ships.

Specific Objectives: Time accurate CFD computations to predict and characterize the unsteady nature of the airwake produced by a US Navy LHA-class ship and an UH-60A helicopter.

Technical Approach: The CFD simulations will be computed at full-scale conditions with second-order time accuracy and assuming fully viscous flow. Turbulence is modeled using the Monotone Integrated Large Eddy Simulation (MILES) approach. The parallel solver used, COBALT, was developed by the Air Force with CHSSI funding. The calculation will be performed using unstructured grids.

Major Applications Software: Cobalt_{60}

Technical and Computational Challenges: The flow is dominated by massively separated regions and vortices. It is imperative that the modeled vortices not be allowed to dissipate prematurely due to numerical issues. The scales involved range from $1/100^{th}$ of an inch resolution in boundary layers to as much as 1000ft from bow to stern of the ship. This, coupled with rather complicated geometries, presents significant gridding challenges. Ship wake flows are inherently unsteady requiring time accurate computations. The solutions will require access to massively parallel machines in order to meet the computational and memory demands of the problem.

DoD Impact: Weapons systems benefiting from the proposed work include LHA-class amphibious ships, the Army UH-60A helicopter, and the V-22 tilt rotor and the JSF, both of which will operate from an LHA platform. In addition, this technology can be applied to carriers and carrier based fixed-wing aircraft. This work will also enhance manned-flight simulation by providing computed, time-accurate ship airwake data for state-of-the-art flight simulation. In the future, this work could impact new ship design, ship modification for improved flight operations and accident assessments.

Schedule: FY 2001, FY 2002 and FY 2003

Keywords: Ship Airwake, Dynamic Interface (DI), Simulation, Time-Accurate, Large Eddy Simulation (LES), Navier-Stokes solutions, Unsteady flows, Unstructured grids, LHA, Wind-over-Deck (WOD), Vortices, and Turbulent flow